



## Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).

$$(3) \ x = \sin 2x = 2x - \frac{8x^3}{3!} + \frac{32x^5}{5!} - \frac{128x^7}{7!} + \frac{512x^9}{9!} + \dots$$

$$\therefore y = 0 \text{ or } 1 = \frac{8x^2}{3!} - \frac{32x^4}{5!} + \frac{128x^6}{7!} - \frac{512x^8}{9!} + \frac{2048x^{10}}{11!} - \dots$$

By reversion of series,  $x = .94775$ , nearly.

$2x = 108^\circ 36'$ , nearly.  $x = 54^\circ 18'$ , nearly.

137. Proposed by L. C. WALKER, A.M., Professor of Mathematics, Colorado School of Mines, Golden, Col.

The first transvectant of the binary cubic and its second transvectant is the *cubico-variant* of the binary cubic.

Solution by G. B. M. ZERR, A.M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa., and W. G. GREENWOOD, A. B., Professor of Mathematics, McKendree College, Lebanon, Ill.

Let  $u = ax^3 + 3bx^2y + 3cxy^2 + dy^3$ , be the binary cubic. Then the second transvectant is

$$\frac{d^2u}{dx^2} \frac{d^2u}{dy^2} - \left( \frac{d^2u}{dxdy} \right)^2 = 0 = (ac - b^2)x^2 + (ad - bc)xy + (bd - c^2)y^2.$$

This is the Hessian of the cubic.

Let  $v = (ac - b^2)x^2 + (ad - bc)xy + (bd - c^2)y^2$ .

The first transvectant of  $u, v$  is

$$\frac{du}{dx} \frac{dv}{dy} - \frac{du}{dy} \frac{dv}{dx} = 0.$$

$$\therefore 3(ax^2 + 2bxy + cy^2)[ad - bc]x + 2(bd - c^2)y]$$

$$- 3(bx^2 + 2cxy + dy^2)[(ad - bc)y + 2(ac - b^2)x] = 0.$$

$$\therefore (a^2d - 3abc + 2b^3)x^3 + 3(abd - 2ac^2 + b^2c)x^2y$$

$$+ 3(2b^2d - bc^2 - acd)xy^2 + (3bcd - ad^2 - 2c^3)y^3 = 0.$$

This is the cubicovariant of the cubic  $u$ .

## PROBLEMS FOR SOLUTION.

### ARITHMETIC.

170. Proposed by J. F. LAWRENCE, A. B., Breckenridge, Mo.

Suppose the market value of 5% bank stock to be  $11\frac{1}{8}\%$  higher than 8% corporation bonds; I realize 8% on my investment, and my income from each is \$180; what did I invest in each?